Communications & Electronics Division

Motorola NEWSGRAM

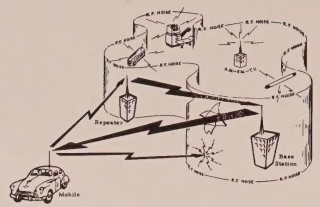
May - June 1952

Sheriff Walter B. Sellmer of Marin County Directs a Patrol Plane Over Rugged California Terrain with a Motorola "Handie-Talkie" Portable

Civil Defense - Public Safety Issue

motorola views . . . .

SYSTEMS DESIGN



The most practicable method for increasing the effective power of mobile transmitters is the improvement of the system receiver sensitivity at the base station. Again and again, poorly designed systems are installed which waste the power in the mobile transmitters. To illustrate this point, consider two possible locations for the base station receiver: Location No. 1 shows an ambient noise level of approximately 1 microvolt, and Location No. 2 shows a very high ambient noise level of 10 microvolts. For equivalent reception, this second high noise level location will require a signal level approximately 10 times as high as the signal level needed for the first location. This means that the mobile transmitter power serving the second location must be 100 times as great as that required for the lower noise level receiving position. In other words, if 1 watt at the mobile transmitter output will give good performance for Location No. 1, 100 watts will be required at the output of the mobile transmitter to give an equivalent performance at the receiver in the second location. There is no better way to increase the equivalent power in a mobile transmitter than by the selection of a low noise level, high elevation base station receiver position.

Unfortunately, the noise level at the mobile receiver position cannot be selected, and that is one reason why it is desirable to have much higher power in the base station transmitter to insure overall effective 2-way communications under the widely varying noise levels encountered by the mobile unit. If the major mobile receiving locations are in the downtown high-noise level district, it is highly desirable to have the maximum signal in that area to provide the best signal-to-noise ratio. This would call for the location of the base station transmitter downtown near the major mobile reception area. Obviously we have opposing conditions, since the desirable downtown location for the transmitter is the undesirable location for the base station receiver. Mobile units on the outskirts of town may have signals too weak to get back to a receiver located at a downtown high-noise-level area. A desirable solution would establish the transmitter in a downtown area and set up the receiver in a low-noise-level cleared area in the outskirts of town with the maximum antenna elevation. If it is impracticable to use both locations for economic reasons, the preferred location for both the transmitter and receiver is usually the location in the low-noise-level area. This selection of the most suitable location for the base station installation cannot be over-emphasized if the system is expected to provide maximum range of communications. You all know that the Connecticut State Police FM system was the first statewide 2-way FM system in the country, but what you may not know is that the success of the system was only partly due to the application of FM. At the time of the Connecticut State Police installation, the sensitivity of FM receivers had not been carried to the present high state of the art, and the Connecticut system was successful primarily because of the attention paid to the overall systems design. The most important detail covered was the selection of the highest and quietest base station location at the center of each police troop area to be served. As each location was spotted, a test transmitter and receiver was installed on the spot and I, personally, made a 2-way communications test run around the boundaries and criss-cross through the most difficult reception areas to test the adequacy of the location. If the base stations had been located at the troop headquarters, the system as a whole would have been a failure. Ranges of 30 miles and beyond were reliable under the carefully selected conditions. Later equivalent city installations with receivers located in noisy downtown areas were limited to 5 or 10 miles. If any of you are dissatisfied with the range of your present systems, I suggest that you try adding a new receiver and install the receiver at the highest elevation and at the lowest noise level you can find. Remember that it is very easy to degrade a 30 watt mobile transmitter to an ineffective 3 watts, or even to 0.3 watts, of equivalent power. Mobile transmitter power costs money; conserve it by an intelligent selection of your base station receiver location.

Dan Noble

The

NEWSGRAM

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Technical Information Center

Communications and
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NEW SERVICE DEPT. OPENS

WEST COAST DEPOT SERVES NINE STATES

June 1st marked another day of progress in Motorola's continued program to better serve its many customers situated all over the nation. On that date a new service department and parts outlet was made available to Motorola users in the states of California, Oregon, Washington, Montana, Idaho, Utah, Nevada, Wyoming and Arizona. Headquarters for this new activity is at 811 B Street, San Mateo, California.

The new West Coast depot is completely equipped to handle parts and service on 2-way radio installations, microwave systems, power line carrier equipment, telemetering equipment and supervisory control installations. Motorola, the leading supplier of this type of equipment, serves between 65 and 70 per cent of the industry in the area.

The regional sales office of Motorola's Communications and Electronics Division and the west coast distributor headquarters for the Consumer Products Division are located in the same building.

POLITICAL CONVENTIONS USE 2-WAY RADIO

When Chicago's GOP and Democratic political conventions get under way, two-way radio will share the air lanes with the vast radio and TV broadcasting networks reaching out across the nation.

Among Motorola two-way radio users at the conventions will be International News Service and United Press. To speed news coverage, INS has set up a two-way radio dispatching system to direct reporters to convention "hot spots" and to relay the information directly to the news room where the copy is written, edited and immediately released to the wire services.

United Press roving photographers using "Handie-Talkie" Portable Radio Phones will keep in contact with UP headquarters situated next to the convention floor. Here the photos will be quickly processed and sent out to all three UP wirephoto networks over the five telephoto transmitters in the UP headquarters.

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EMERGENCY RADIO NETWORK AIDS FLOOD STRICKEN AREA

Motorola Production Scheduled On Round-the-Clock Basis To Meet Disaster Demand

Two-way radio communications equipment played a leading role in winning the desperate fight in the Omaha-Council Bluffs area to keep the flood swollen Missouri River from breaking through levees and inundating the homes of 30,000 residents in the two cities. Besides the residential sections, the flood threatened to do millions of dollars of damage to the east Omaha industrial area that contains the city's major railroad, electric power, and manufacturing centers, as well as the municipal airport.

About 2500 volunteer workers were enlisted in the emergency campaign carried out by the city of Omaha, the U. S. Army Engineers, the Red Cross, and civilian defense units. The responsibility for the 10-mile stretch of levee in the critical area was undertaken by the Union Pacific Railroad, whose shops and freight yards are located there.

To provide constant on-the-spot-communications between levee patrols and repair gangs, 55 portable "Handie-Talkie" radiophones were turned over to disaster crews by Motorola.

These compact portable 2-way radios were assigned to patrols covering the levees on both sides of the river. Patrols were in constant radio contact with three remote units in the City Hall, in the office of Chief Engineer W. C. Perkins of the Union Pacific, and in the mobile U.P. Repair Shop. These remote units all operated through the U.P. central station and antenna atop the U.P. Building. A number of major breaks in the levee were prevented by this hastily improvised system, through which flowed all flood reports. Repair crews were dispatched within seconds after an alarm had been sent.

Twenty additional portable 2-way radio units recently purchased by the Omaha Fire Department were loaned to the Union Pacific at the request of Fire Commissioner William Noyes. These units were used to coordinate operations between the Fire Department and the Union Pacific patrol groups. The fire department also obtained units with which to keep in contact with police department cruise cars and central control offices.

Motorola rushed out an additional 27 "Handie-Talkie" portables for use by the U. S. Army Corps of Engineers. In addition the company had its Chicago Communications plant operating on an emergency basis in order to furnish the flood stricken areas along the river with all the radio equipment possible. Two-way radio gear normally requiring 6 weeks for delivery was made available within 12 hours. The Omaha Motorola office operated on a 24-hour emergency basis with four radio communications engineers placed at the disposal of any of the organizations requiring aid.

The Northern Natural Gas Company, which operates over 1000 miles of pipe line that runs through the Missouri Valley, and has over 250 mobile 2-way radio units, cooperated in the work by pressing its communications equipment into immediate service.

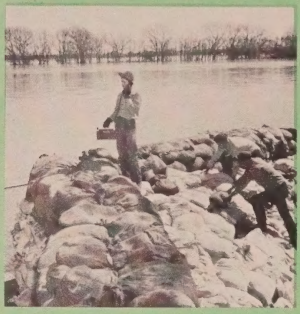
Besides the above organizations, four taxi companies in the two cities volunteered the services of their radio-equipped cab fleets during the emergency.

The Omaha fire department has five mobile radio units which were in constant contact with other fire units or any of the 80 radio-equipped cruise cars and motorcycles operated by the police department.

The Omaha Public Power District had 65 mobile 2-way radio units in operation in the area. The Omaha City Street Railway also had 2-way radio equipment available.

On the Council Bluffs side, the amateur radio operators took a leading role by patrolling the evacuated residential areas which were under martial law, as well as carrying out levee patrol activities.

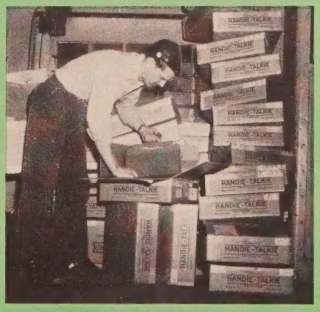
The flood emergency proved that this 2-way radio equipment could be combined to make an extremely efficient and important tool in any kind of civic emergency. Within a week's time a smoothly functioning system of radio control and co-ordination was established. The U. S. Corps of Engineers were particularly enthusiastic about the effectiveness of the system, despite the fact that it was organized almost overnight.



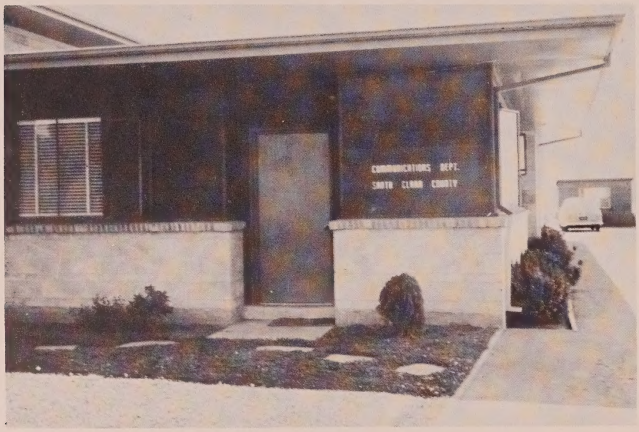
Left, a member of the U. S. Army Corps of Engineers receives instructions via 2-way radio; **center,** M. J. Timmons, an official of the Omaha Civilian Defense Agency, makes radio contact from a levee near the Socony Vacuum Bulk Plant at Omaha; and **right,** sand bagging wall around city water supply pumping station at North Omaha. In the event of a break through, repair gangs can be dispatched to the scene in a matter of minutes.

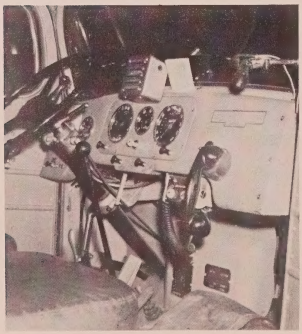
Right, sand bagging levee at the Dodge Reservoir at Council Bluffs, Iowa. A levee patrol boat maintains vigilance at a critical point in the river near North Omaha. Pumping station is within 100 yards of this point.

Bottom left, trucks loaded with sand bags strengthen wall in the event that flood waters undermine foundations; **bottom center,** "Handie-Talkie" 2-way Radiophones are rushed to the flood scene; **bottom right,** constant surveilance and emergency sand bagging operations prevent "sand boils" from by-passing levees and flooding critical areas.



AN ECONOMIC APPROACH TO COUNTY COMMUNICATIONS





Above: Front entrance of the Santa Clara County Communications Department Building at San Jose, California. This building is also headquarters for the County Fire Department.

Left: Mobile radio installed in 2000 gallon water tanker of the County Fire Department.

Santa Clara County Provides Service To All Tax-Supported Public Safety Agencies

In January 1948, the County of Santa Clara, California was faced with the problem of establishing a public safety communications system to provide for the expanding police and fire services. After conducting various surveys, the Board of Supervisors, following the example of Kern County, California, established the Santa Clara County Communications Department.

The Communications Department was given the responsibility of providing communications service to all tax-supported public agencies within the county that desired to avail themselves of such service. All of the cities within the county, except San Jose and Palo Alto which already had operating systems, were quick to take advantage of this new service.

The county communication system's control station is at San Jose. This is central dispatching headquarters for "County Radio" for the law enforcement agencies, and "Fire Control" for the fire agencies. Both systems operate on a simplex basis using Motor-

ola 250-watt base station equipment.

"County Radio" is used to communicate with all sheriff's cars, district attorney's units, the county photographer and the county poundwagon, as well as the Santa Clara and Los Gatos police cars and motorcycles. The system provides complete coverage to over ninety-five percent of the county. If necessary, reliable communications may be obtained with mobile units up to one-hundred miles away from the county.

Also located at San Jose is a 60-watt base station transmitting on the Northern California point-to-point frequency. This provides communications with adjacent cities and counties. Additional Motorola 30 watt base stations are located at Sunnyvale, Mountain View and Gilroy.

"County Radio" serves as the control station and assists the California State Highway Patrol in handling traffic on file checks, registration information, and accident reports. A portable base station, two completely equipped communication trucks, "Handie-Talkie" portable radiophones and pack sets are available to be used in any emergency.

A Motorola 250-watt base station is the key to the county-wide coordinated fire system. In addition there are eight 60-watt base stations and thirty mobile units in the system. Fire control operators do all the dispatching for the county fire department. Motorola QUIK-CALL equipment is installed at the dispatching stations and at all fire stations. When the proper tone combination has been received, the fire alarm bell in each station is actuated.

The time for fire dispatching is from five to ten seconds. Coordination between police and fire agencies is handled by the control station.

The entire radio system is under the supervision of Chief Radio Technician R. A. Mason. His staff consists of only three technicians and six control operators. In addition to the many base stations, the system employs 78 Motorola mobile units.

Other advantages of the "Communications Department" type of operation is that the burden of test equipment expense is shared by the many agencies served. Thus for a small individual investment, the fastest and highest quality service can be bought. Standardization of equipment, too, means greater dollar savings.

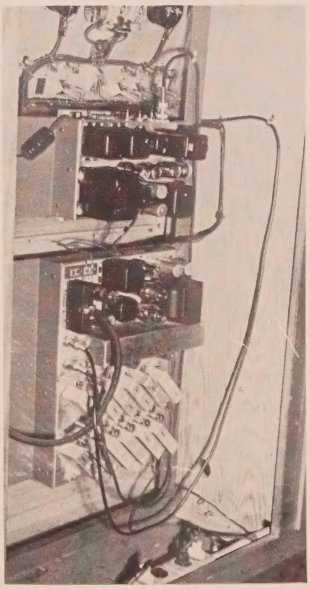
The Santa Clara County system has been in operation for more than three years. It has handled many problems that involved multiple agencies, and with the coordination feature of the system, all concerned were aware of all phases of each incident as it developed.

From what has been done in Santa Clara County, it is apparent that the "Communications Department" type of operation is here to stay!

Above, left: Operator Don Wade at QUIK-CALL control box used to dispatch fire apparatus.

Above, right: Betty Beatie and Don Wade, operators, at the main operating console.

Below: Fire alarm selective calling equipment installed in the rear of the main console.

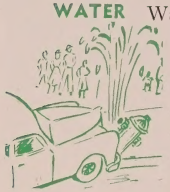


Kansas City's New . . .

MUNICIPAL RADIO SYSTEM

June 24, 1952 was the first anniversary of one of the nation's largest, most modern and unique municipal FM 2-way radio communications systems. On that date, Kansas City, Missouri completed a full year's operating experience with a vast communications network serving all bureaus and departments engaged in mobile operations. Roy DeShaffon, Supervisor of Communications, Kansas City Police Department, Harvey Baldwin, Fire Chief and Henry Johnson, Police Chief have set the pace with this ultra-modern municipal radio system.

POLICE Three police dispatchers in the main communication building maintain 24 hour three-way radio communication among 125 police cruisers, patrol traffic safety and commissioned officers' cars; 25 motorcycles; 11 Sheriff's cars in Jackson County; two in Clay County; three North Kansas City police cars; and one park patrol car.



WATER Water Department radio dispatchers located in the City Hall direct normal maintenance and services of 45 vehicles and dispatch crews to water main and hydrant breaks, sprinkler system breaks and other emergencies.

HEALTH Five City ambulances operating from the control center at General Hospital respond to police radio calls from scenes of accidents, disasters and other emergencies and can be dispatched by radio from scene to scene.

LIQUOR CONTROL Two investigators' cars operating on the police frequency respond to police dispatcher calls and investigate causes of disorders in taverns and other licensed establishments.

STATE POLICE The main police radio station serving also as an inter-zone station link by radio telegraph directly to all state police in the nation and to headquarters of metropolitan police in major cities. The station is also a relay station in the inter-state police radio network.

FIRE Dispatchers in fire headquarters and the fire alarm building by remote control direct 56 fire-fighting vehicles, officers' cars, and the fire underwriter's control. The Fire Chief can direct all fire-fighting forces by radio in emergencies.

WELFARE Two cars from the Welfare Department's animal shelters answer police radio calls to pick up stray dogs, cats and other animals and make quick investigations of rabies reports.

PUBLIC WORKS Public Works Department dispatchers located in the City Hall and Public Works Garage dispatch emergency crews and cars to scenes of damage from wind storm, flash floods and traffic blocks in sleet and snow and direct normal operations of 25 service vehicles.

CIVIL DEFENSE Police dispatchers are prepared to assist the Civil Defense Department Red Cross, disaster units and amateur radio operators who may be mobilized for national emergencies or area disasters.

FEDERAL Station facilities are available for emergency broadcasting to federal law enforcement cars, military police, shore patrol and the provost marshal of the area.

For the complete system design and application story of this $500,000 mobile radio network, see Milton Sleeper's *FM-TV RADIO COMMUNICATION*, July 1952 issue.

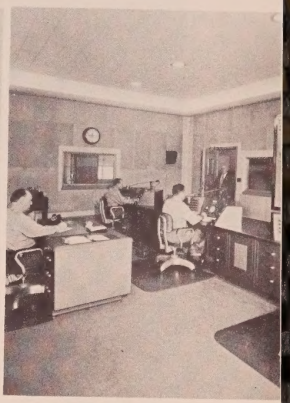
Roy DeShaffon, Supervisor of Communications, Kansas City Police Department.

Henry Johnson, Chief, Kansas City Police Department.

Harvey Baldwin, Chief, Kansas City Fire Department.

Main transmitter Room showing six Motorola 1/4 Kw. transmitters and associated equipment.

Three triple skirt coaxial antennas mounted on a 300-foot self-supporting tower.



Three paralleled remote control consoles in the police radio dispatch room.

Main police headquarters include a complete drive-in radio service facility.

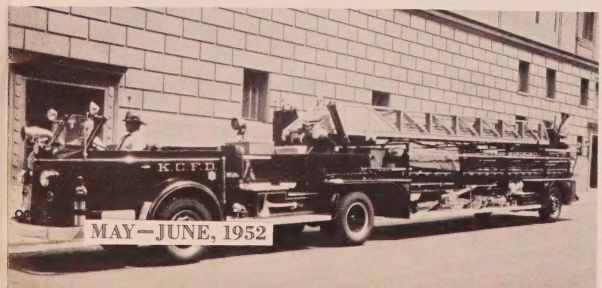
A view of the elaborate bench test set up in the police radio repair department.

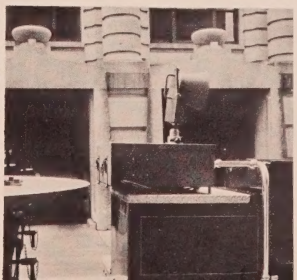
All police motorcycles are Motorola equipped.

All Kansas City fire vehicles have F.M. 2-way radio. A weather proof housed unit is installed behind the driver on this 100 foot aerial apparatus.

A close-up of the fire truck radio unit.

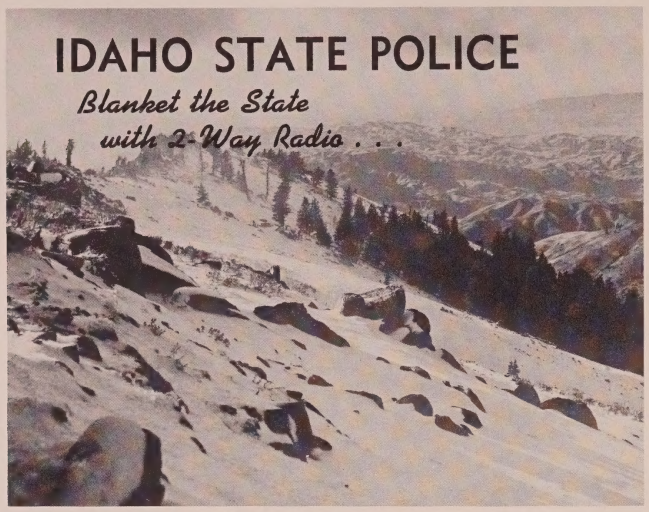
Radio dispatch facilities at Fire Alarm Headquarters.





IDAHO STATE POLICE

Blanket the State with 2-Way Radio . . .



Above: With radio Lt. A. E. Perkins is within easy reach of the ports of entry on main highways leading into the state.

Below: Engineer Edson French in the radio shop.

The state-wide law enforcement agency of Idaho, under the direction of Commissioner Wayne Summers, is proud of its state police organization. One of the most effective and modern law enforcement agencies in the nation, this aggressive organization is completely equipped with Motorola 2-way radio.

Tie-in with local sheriff offices and police departments permits state wide coverage. The system was developed on the basis of the state, county and city governments each contributing one-third to the cost of the individual stations in each area. Each agency purchased its own mobile equipment. The base stations are all licensed to the state of Idaho; the mobile units are licensed to the individual users. A cooperative letter of agreement among all agencies permits combined operation on the state police frequency of 42.54 mc.

Additional state police equipment includes a 2-way radio equipped plane. Especially useful for directing search parties, the plane because of its high altitude can easily communicate with the twelve state owned "Handie-Talkie" portable radiophones—or just as easily with units a hundred miles distant. Weighing less than ten pounds, the "Handie-Talkie" units are used on horseback or snowshoes as the situation demands.

Left to right: Edson French, state radio engineer; Chet Moulton, state director of aeronautics; and A. P. Bunderson, superintendent of state police, examine a Uni-Channel Sensicon Dispatcher to be installed in a state plane.

Lt. A. E. Perkins and Officer Jack Tucker of the Idaho State Police beside a 2-way radio equipped patrol car.

A completely equipped radio dispatched service car provides on-the-spot maintenance for remotely located base station equipment.

A driver of a California Packing Corporation truck reports over his 2-way radio to the dispatcher on activity in one of the fields. Without 2-way radio he would have to take his report to the office.

The dispatcher sends out a call to one of the radio-equipped vehicles on the California Packing Corporation farm near Rochelle, Illinois.

2-WAY RADIOS SPEED UP DEL MONTE FARM OPERATIONS

Farmers who grow crops for canning know how important it is to harvest vegetables at exactly the right stage of maturity. Peas, for example, are sweet and tender if harvested at just the proper time, but if left on the vines even a few hours too long, they begin to lose the freshness, tenderness and flavor that canners and consumers demand.

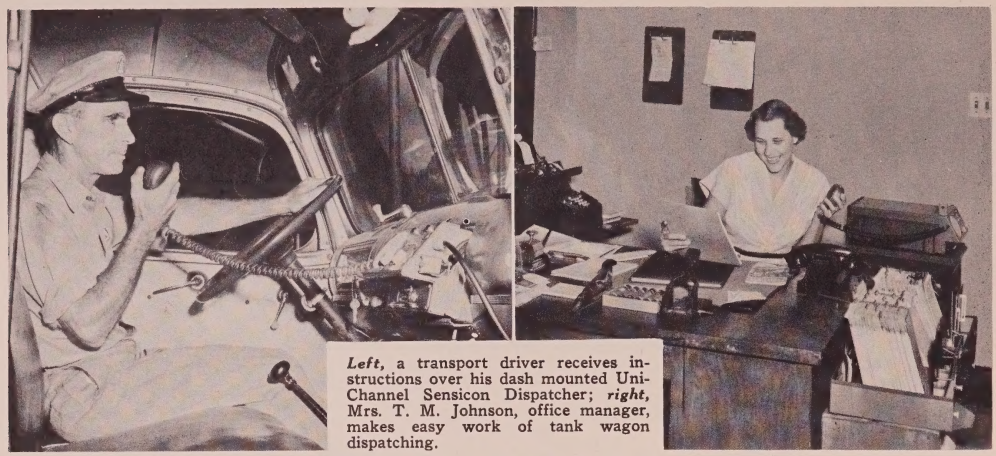
The Midwest Division of the California Packing Corporation, with headquarters in Rochelle, Illinois, has found that the use of Motorola 2-way mobile radio helps save precious time during the critical harvesting period. When a field has reached the stage of maturity, crews and equipment are immediately radio dispatched to the field to begin the picking operation. In this way it is possible to maintain the high quality for which DEL MONTE is famous.

Another major use for 2-way radio by Calpak is in getting spare parts to equipment that has broken down in the field so that work stoppage is minimized. A tractor may require a new clutch. The supervisor will immediately call the Parts Manager by 2-way radio. He, in turn, will contact a repair truck wherever it might be and direct it to the point where it is needed.

The use of 2-way radio by the DEL MONTE organization has also proved itself of value in case of accident or emergency. A radio message from the field to the central dispatcher can bring a doctor or an ambulance within a matter of minutes.

Besides the plant and fields near Rochelle, Calpak's Midwest Division also has operations in DeKalb and Mendota, Illinois, Arlington, Wisconsin and Sleepy Eye, Minnesota. Each of these has an individual base station transmitter-receiver unit with 12 to 25 mobile units, all of which are Motorola.

A double check on the size of a fan needed in the field is made by the radio dispatcher before he sends a man out with it. By such a re-check there is no chance of a wasted trip.



Left, a transport driver receives instructions over his dash mounted Uni-Channel Sensicon Dispatcher; *right,* Mrs. T. M. Johnson, office manager, makes easy work of tank wagon dispatching.

MIDWAY OIL CORPORATION INITIATES "DEGREE-DAY" SYSTEM WITH 2-WAY RADIO

Distributor of Cities Service Products Keeps Customers' Tanks Full

Midway Oil Corporation of Graham, North Carolina early last fall recognized the importance of 2-way radio in the distribution of oil products. A distributor for Cities Service, this small corporation was the first in the state of North Carolina to use 2-way radio for this application.

The company operates in the industrial and agricultural county of Alamance. Within this area are five incorporated towns and ten unincorporated villages widely scattered throughout the county. Each town and village has one or more industries.

MILEAGE SAVED

The contributing factor in Midway's decision to streamline its operation with 2-way radio was a cost consideration. Actual tank truck mileage is expensive. With their small scale operation, Midway Oil found that a saving of up to fifty miles in one day was not unusual. These savings were realized through careful planning and scheduling of truck deliveries.

SERVICE

Recently the company instituted a degree-day system under which perpetual records are kept of the amount of oil in a customer's tank. The system was established on a trial and error basis. Within a few months the methods were formalized to such an extent that the records are now exceptionally accurate. A customer need never call to replenish his supply; nor will he ever be out of oil because of failure to "stick" the tank. The system requires more paper work, but the cost is small when compared with savings through planned operation and customer satisfaction.

GOOD WILL

With adequate facilities, a degree-day system, a capable staff and 2-way radio, the firm is able to offer unexcelled service to its customers. This is, of course, soon reflected in increased profits.

Mr. T. M. Johnson, manager of the firm, has many interesting experiences to relate concerning his operations with 2-way radio. According to Mr. Johnson, a lady called one morning asking when her oil was to be delivered.

"I'm going shopping and want to make sure I'm back by the time the truck gets here," she said.

Mr. Johnson, without her knowing it, picked up the microphone and relayed her message to a tank truck.

"The truck," he informed her "is in front of your house now." It took her a while to discover how he, at his office, knew that the truck was in front of her house.

"We're getting a lot of service —and having a lot of fun with our radio station," remarked Mr. Johnson.

RADIO EQUIPMENT

To use the 2-way radio, the firm received a permit from the Federal Communications Commission. Their station was assigned a frequency of 35.86 mc. with an authorized power of 40 watts. Actually only 12 watts of power was found adequate to provide full coverage.

RADIO REACHES INTO HOMES OF WYOMISSING, PA. FIREMEN

Dispatcher Harry Grill operating the base station in the engine house transmitting room.

Assistant Chief Jacob Ruth receives a call from headquarters over a specially adapted home receiver.

A message is transmitted from fire truck to fire station by Chief Jesse Brown of the Wyomissing Fire Company.

An efficiently operated, completely modern fire department having 2-way radio communications equipment is no longer reserved only for the large, metropolitan fire-fighters. How 2-way radio is used in a small fire department is the story of the Wyomissing, Pennsylvania Fire Company.

Wyomissing, situated in southeastern Pennsylvania, has a population of only 3,320 people. Fire protection for the borough is provided by a small company of 23 firemen. Its fire apparatus includes two modern Mack trucks with complete equipment—plus a two-way radio system to provide communications between the trucks and control point in the transmitter room of the engine house.

A unique radio fire alarm system has been set up to quickly notify company personnel when an alarm has been sounded. The alarm is received by the dispatcher at the engine house. He immediately relays the message via radio directly into the homes of all the Wyomissing firemen. The message is received over specially adapted home radio sets tuned to the assigned transmitter frequency 24 hours a day.

This procedure, according to Fire Chief Jesse Brown, has a number of advantages. Immediately after receiving the message, the firemen have detailed information as to the location and seriousness of a blaze and know exactly what kind of a situation is confronting them. Too, the control room operator can advise the men whether there are victims of burn or other injuries, whether an ambulance is needed, and whether more men are required at the scene of the blaze.

Covering the cost of the radio system was made a community-wide project. Individuals, civic organizations and business firms each took part in the campaign. Borough residents contributed a total of $1300. The ladies auxiliary of the fire company added $500, and the company itself contributed another $600.

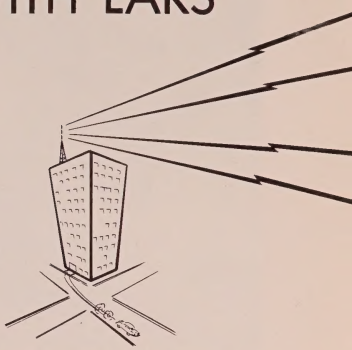
Recently the Wyomissing Company held an "open house" to express their appreciation for a helping hand and to proudly display the new radio system that has made more effective fire protection possible.

(Reading Eagle Photos)

A NEWSROOM WITH EARS

Above: Interior of the Columbus Dispatch communications room showing the rack mounted Motorola receivers. Operator channels incoming calls directly to the newsroom.

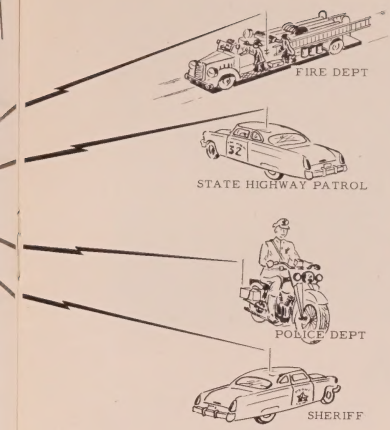
Above: A crime or serious accident reported to the newsroom sends a reporter or photographer directly to the scene in a radio-equipped press car.



The Columbus Dispatch, a Columbus, Ohio newspaper enjoys an exceptionally envious position in regard to the local reporting of fires, traffic accidents, thefts, murders and other types of crime in Columbus and the surrounding territory. The reason: The Dispatch has ears, six of them. It monitors all transmissions emanating from the two-way radio transmitters of the public safety agencies in the entire area. The radio messages are received over the six Motorola station house receivers located in the Newspaper's communications room. Any newsworthy information picked up at the communications room is quickly relayed to the newsroom where a staff reporter and photographer are directed to the scene.

The six communications room receivers are tuned to the frequencies used by the Police Department, the Fire Department, the Sheriff's Office and the Ohio State Highway Patrol—all of which are completely or partially equipped with Motorola two-way radio. The extent of news coverage can be had by viewing the extensive communications network monitored by the Dispatch.

Police department calls alone represent a sizeable volume. Ordinarily between 800 and 900 calls are made daily from either the police department radio station or the 143 cruisers, detectives' cars, motorcycles and other police vehicles. In addition, the police departments of four surrounding



cities are handled through the Columbus station.

The city wide fire department radio network is in contact with 55 radio-equipped vehicles in the fire service plus several individual stations such as those of Port Columbus and North American Aviation, Inc.

Between 500 and 750 calls every 24 hours are handled by the Sheriff's radio station. These calls go out to the 20 radio-equipped Franklin County cars and to the Franklin County Fire Fighters Association operating in the outlying cities and townships.

Ohio State Highway Patrol messages monitored by the newspaper reach out over a total of five counties.

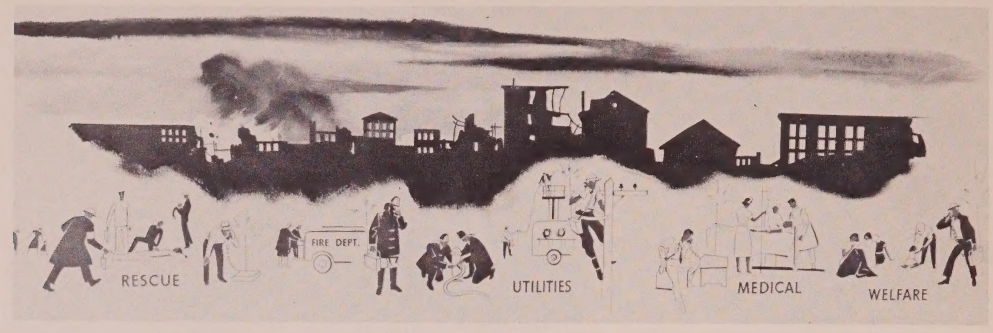
Understanding the messages of the police radio dispatcher is not an easy task. All messages are coded. For example, a collision between two cars at Broad and High Streets is no accident as reported over the two-way radio. Instead a police squad car is sent to Broad and High to investigate Signal A. Once the "key" language has been mastered, however, the newspaper can have men on the scene in minutes, and often before the police arrive.

Regarded as the finest newspaper set up of its kind in the nation, the system is operated with full cooperation of the various public safety agencies involved. (Photos Courtesy of The Columbus Dispatch)

Above: Sgt. J. W. Brook (left) and Patrolman Jack Ray send out a message to the Ohio State Highway Patrol. Information is received simultaneously by the newspaper.

Above: Police Patrolman J. Siders of the Columbus, Ohio Police Department sends a coded report to headquarters over his Motorola mobile unit. Newsmen must know "key" language.

Above: Capt. J. C. O'Connor (left) and Charles Kreig. Fire truck is one of 55 radio-equipped vehicles in the fire service.



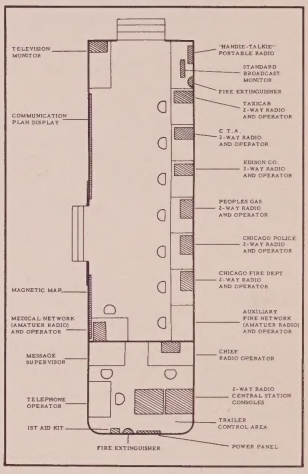
for an ALERT AMERICA . . .

CHICAGO CIVIL DEFENSE OFFICIALS DESIGN A MOBILE RADIO COMMUNICATIONS NETWORK FOR MAJOR DISASTERS.

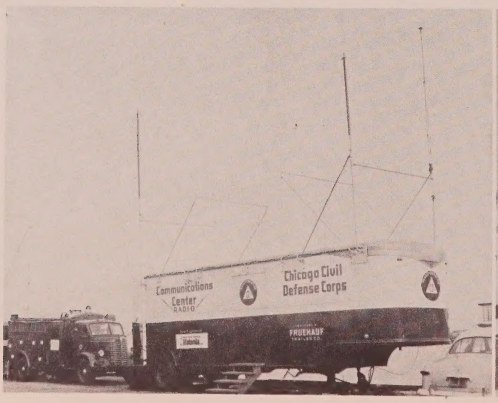
Above: Civilians and service personnel inspect the interior of the 2-way radio equipped truck trailer at a recent Chicago Civil Defense Demonstration.

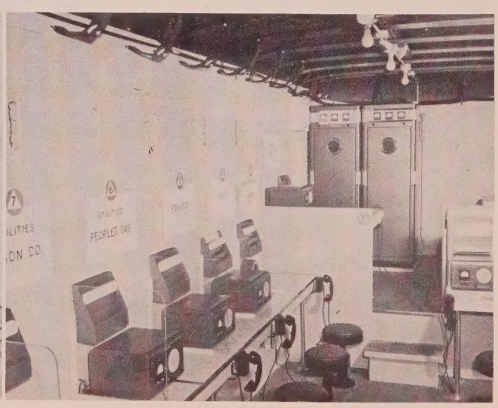
Right: Officials of the Chicago Civil Defense Corps (left to right) Anthony J. Mullaney, Alfred C. Witt and Daniel A. Sullivan look over the plans for the mobile Communications Center.

Below: Exterior and interior views of the mobile Communications Center.



Above: Trailer floor plan showing radio tie-in with various public agencies.





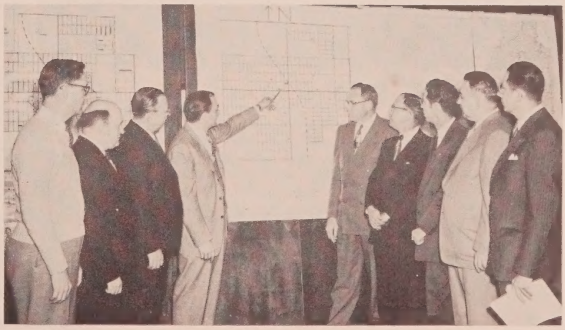
EVERGREEN PARK

CIVIL DEFENSE

Above: Law enforcement officials of Evergreen Park, Illinois take part in a mock air raid test designed to train civil defense personnel for an actual atomic blast.

Right: A radiological monitor for checking radio activity is held near a messenger who has recently left "bombed" area. Two-way radio communication is maintained with nearest de-contamination center.

Left: Alfred C. Witt, training chairman of the Chicago Medical Civil Defense Amateur Radio Network holds a briefing session to familiarize personnel with details of the test. The communication network included 10 mobile units, 6 portable radiophones, 3 base stations and a radio equipped C.A.P. plane.



Right: Evergreen Park and Cook County officials review details of the mock air raid with Chicago Medical Amateur Network Activity Directors. Observers from twelve communities in the Chicago area participated in the Evergreen Park test.

A PICTORIAL OF MOTOROLA-EQUIPPED

Above: Chief of Police Glenn DeRock of Hillsboro, Oregon. In the background is a Motorola ¼ Kw. base station used for law enforcement and fire control for the city of Hillsboro and Washington County, Oregon.

Los Angeles Times Photo

Above: Officer M. N. Alexander (left) and Detective J. W. Breen of the Los Angeles Police Department with burglary suspects trapped with the aid of two-way radio. Officers with "Handie-Talkie" Portable Radio Phones were stationed at a vantage point in a hotel from where the robbery could easily be seen. The portable units were in contact with ten policemen cruising about the neighborhood in radio equipped cars. When the suspects attempted to leave the scene, the squad cars converged upon them.

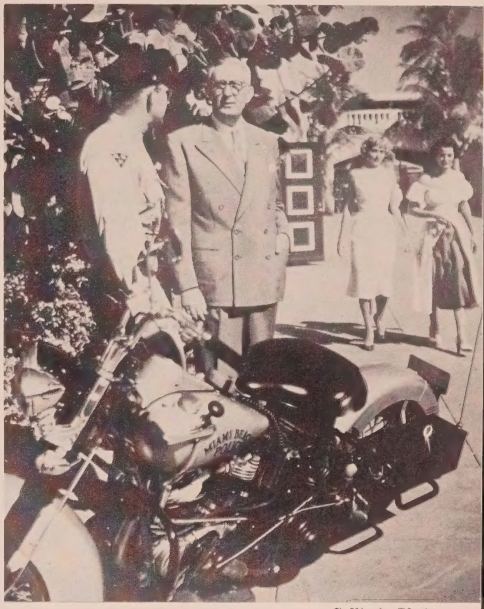
Boston Sunday Advertiser Photos

Above: Trooper Kenneth Wood (left) and Trooper Chester Emmons of the Maine State Police on patrol communicate with their home station via two-way radio.

Right: Keeping in constant touch with the many units of the Maine State Police is the responsibility of Sgt. Roland Paquin (left), Chief of Communications. On the right is Lt. John deWinter, Director of Traffic Safety.

L CROSS-SECTION
ED PUBLIC SAFETY AGENCIES

Above: Police Chief R. E. Smith (right) and Officer Lee Hummel of the Barrington, Illinois Police Dept. Desk-top console on the right is a locally controlled base station with a receiver and 60-watt transmitter.

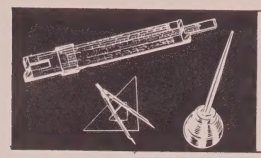


Collier's Photo

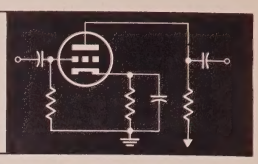
Above: Mayor D. Lee Powell of Miami Beach, Florida, alongside one of the many Motorola two-way radio equipped motorcycles owned by the Miami Beach Police Department.

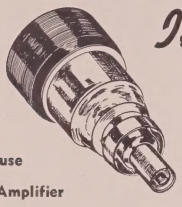
Above: In Texas, where miles are longer than anywhere in the U. S., Irving, Texas, Police Chief Joe Reynolds is within easy reach of all radio-equipped police cars.

Left: C. Glen Wilson of the Illinois Bell Telephone Company directs an emergency call to central headquarters over a "Handie-Talkie" FM Radio Phone. This picture was taken during recent civil defense tests made by the telephone company to determine its readiness in case of an atomic disaster in Chicago. (Photo courtesy of Chicago Tribune.)



Technical Notes Section





Lighthouse Triode Power Amplifier

Introducing . . . .

Motorola's 450-470 Mc. FM 2-WAY RADIO EQUIPMENT

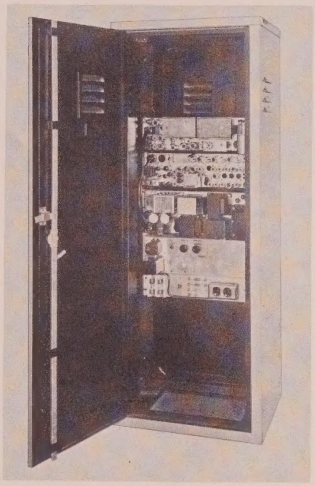
Radio at 450 mc. has posed new and unique design problems to development engineers. Conventional inductance-capacitance tuned circuits are impractical, electron transit time in tubes begins to have effects, the resonant frequency of standard tube types is exceeded and tuned cavities become of increasing importance. The advent of FM two-way radio at 450 mc. has produced a wealth of new developments both in circuitry and production techniques.

ALLOCATIONS

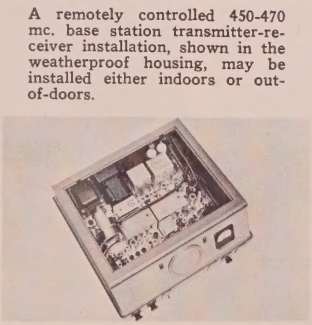
The 450-470 mc. range, recently officially authorized by the F.C.C., is open to two types of uses. The 450-460 mc. range contains specific channel assignments for Broadcast Remote Pickup, Land Transportation, Public Safety, Industrial and Domestic Public Services. The 460-470 mc. range ("Citizens Radio") is open to virtually anyone. Radio systems with heavy traffic overloads and shared time operation as well as qualified would-be operators may now use the relief facilities in this new band. Private industries and businesses, previously ineligible for licensing may now utilize the full advantages of two-way radio through use of the 460-470 mc. range.

RESEARCH

The utility of these frequencies was proved by the military during World War II. Motorola has supplied many radio repeater systems in this band for special applications in the last few years. Early in 1951, Motorola supplied the first 450 mc. police mobile radio installation to the City of Miami, Fla., Police Dept. These installations, plus a multitude of other laboratory tested models form the basis for the newest line of 450-470 mc. mobile and base station models.



A remotely controlled 450-470 mc. base station transmitter-receiver installation, shown in the weatherproof housing, may be installed either indoors or out-of-doors.

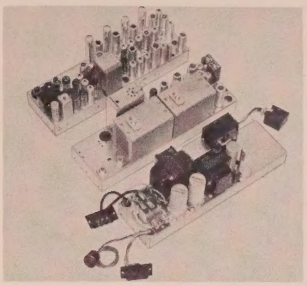


The desk top console model base station employs the same 40 watt transmitter and Sensicon receiver as its remotely controlled counterpart.

One of the limiting factors to earlier mass production of this type of equipment was the tube complement. Tube manufacturers, caught in a post-war television boom, could not economically produce the limited amounts of special purpose tubes required. Much of the production of suitable high quality—and high cost—tube production was channeled to the Armed Forces. Several types of imported and domestic tubes were evaluated and were eliminated by high cost, availability, electrical or mechanical shortcomings or inadequacy for mobile applications. Allocation of frequencies in the 450-470 mc. range plus impending release of UHF television channels spurred both design and production of suitable tubes. Motorola waited until reasonably priced, dependable tubes were both available and time-tested before proceeding with full scale production.

TRANSMITTERS

The transmitter driver and final amplifier tubes, 2C39A's, are JAN



The basic building blocks of a mobile unit consist of the Sensicon receiver and the 20 watt transmitter, both interchangeable between base stations and mobiles, and the vibrator power supply.

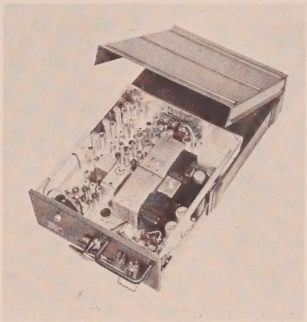
accepted, military proved lighthouse type triodes. The tubes are mounted in tuned cavities, utilizing the inherent shielding to minimize spurious and harmonic emissions. The tube manufacturer guarantees 1000 hours of operation of these tubes at rated load but military use has shown performance of many times this limit. In mobile 18-20 watt transmitters, the tubes are operated at less than 10% of their rated plate dissipation, further prolonging the expected tube life. Efficiencies of more than 65% are realized. In base station models, the plate supply voltage is approximately doubled and a blower is added to achieve a power output of 38 to 40 watts. Although these tubes are slightly more expensive than less suitable types, the increased efficiency, power output and expected life more than compensate for the difference.

Crystal frequency multiplication is kept at a low level (24 times) to insure freedom from spurious (crystal harmonic) radiations plus achieving a high degree of carrier stability for use with selective receivers. The standard Motorola Instantaneous Deviation Control circuit is utilized to obtain full ± 15 kc. deviation with either a whisper or shout into the microphone while still retaining absolute modulation limiting.

RECEIVER

The principles of the Sensicon receiver, proved so successful in the 25-50, 72-76 and 152-174 mc. ranges, have been carried through into the 450 mc. receiver. Sealed selectivity in the Permakay filter, the noise compensated squelch circuit, the capacitance discriminator, sealed ISO-Q midget tuned cavities, and other Motorola patented developments are used.

Incorporation of automatic frequency control assures that the signal cannot be lost or distorted by either the transmitter or receiver drifting off the center frequency. The receiver is always "in tune" with the transmitter.



The split-top mobile housing with a sturdy locking handle affords servicing accessibility but yet full protection to the chassis enclosed.

A standby "drain-saver" circuit, minimizes receiver power consumption while no signal is being received but acts instantaneously when the squelch threshold is exceeded. A threshold sensitivity of 0.3 microvolts assures that even the weakest signals will be received. Only one microvolt is required for full 20 db. noise quieting.

Multiple RF stages employing high frequency tubes and silver plated sealed tuned cavities afford a high signal to noise ratio, excellent sensitivity and high spurious and image response rejection (more than 85 db.). Triple conversion is used, confining temperature effects to low frequencies where they are easily compensated. The plastic encased Permakay filters, impervious to temperature, humidity and vibration, forms a bulwark against obsolescence. The entire unit is replacable to achieve greater selectivity protection if it is required by changes in channel assignments. A modulation acceptance of ± 15 kc. with less than 6 db. attenuation plus a "skirt" attenuation characteristic of –85 db. at ± 60 kc. affords optimum selectivity protection.

MODELS

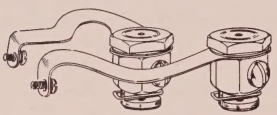
Mobile models are housed in the standard "Research" line split-top housing for accessibility and ease of servicing. A new vibrator power supply achieves high efficiency and superior dependability. Locally controlled base stations are housed in the "BY" desk top console cabinet and remotely controlled models are housed in the "J" weatherproof cabinet. These models are the result of many years of study, planning, designing and testing. Motorola has continued the policy of building only the finest radio communications equipment. The "designed-in" and "built-in" extra features insure that maintenance costs will be kept at a minimum and amortization periods will be extended to provide radio service at the lowest possible cost per message.

Easily mounted in either the horizontal or vertical position, the 450 mc. mobile unit is adaptable to any mobile installation.

SERVICE HINTS and SHOP NOTES

829B CONNECTORS

Under conditions of high transmit duty cycles or nearly continuous transmissions, the 829B final amplifier tube in Motorola 60 watt, 152-174 mc. transmitters dissipates considerable heat. Much of this heat is carried to the external circuitry through the tube plate leads. To obtain greater heat radiation and greater protection for the external circuitry, all current shipments include new heat radiating plate connectors. Earlier models may easily be modified to include these new connectors if desired. Replacement is accomplished by removing each of the earlier friction type connectors and its integral plate strap and installing the replacement connector and strap in its place.



Heat dissipating plate connectors for 829B final amplifier tubes in 60 watt 152-174 mc. transmitters provide circuit protection.

New connector assemblies are available from the Motorola Parts and Service Dept., 1327 W. Washington Blvd., Chicago 7, Illinois. Part No. 1X813319 includes the left connector, plate strap and mounting hardware. Part No. 1X813320 is the complete right hand assembly.

DUST PROOFING

From a servicing standpoint dust presents two problems to the technician. Firstly, a chassis covered with dust is not conducive to best service and repair procedures and secondly, dust inside coils, in relays and around components may actually cause the equipment performance to degenerate. All Motorola mobile housings are built without louvers and vents to achieve maximum protection from both dust and splashing water. However, with anything less than a hermetic seal, it is virtually impossible to keep fine dust out of the equipment in dry areas.

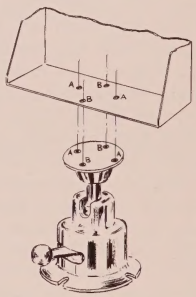
One solution, utilized by W. A. Kellogg of the Radio-telephone Service Company of Stockton, California, is shown in the photograph. A plastic (polyethylene or equivalent) bag is placed entirely around a Uni-Channel transmitter-receiver. Scotch type polyethylene tape seals the openings. The installation is thus both dustproof and moisture proof.

A polyethylene bag affords both moisture and dust protection for a mobile radio unit.

FIRE TRUCK SPEAKER

Early versions of the P-9084 weatherproof fire truck speaker may be made more rugged and more resistant to the effects of vibrations by this simple modification.

Two new mounting bolts are added as shown in the accompanying sketch. Drill two ¼" holes (drill size E) in the swivel base and tap the holes for 20 NC-2 threads. The holes are in the same bolt hole circle, 90° displaced from the two existing holes. In the speaker mounting bracket, drill two .281" holes (drill size K) to mate with the holes in the base.



"A" denotes the existing mounting bolt holes and "B" denotes bolt holes to be added.

Reassemble the speaker, bracket and base, adding two ¼-20 x ½" bolts with washers and lockwashers in the new holes. The new bolts add rigidity and prevent the heavy speaker from placing excessive strain on the mounting facilities under conditions of vibration.

DYNAMOTOR RELAY

A simple test may be used to make a quick check of the primary power circuits in a mobile transmitter-receiver unit disclosing a commonly overlooked cause of shortened life of dynamotor, vibrator and relays.

Connect a voltmeter, set to a low voltage DC scale, across the contacts of the "A" power relay. The normal voltage drop across the contacts will be only a few millivolts. Now press the push-to-talk button. A noticeable deflection of the meter needle on the 10 VDC scale indicates improper operation.

Dynamotor starting current surges will normally exceed 100 amperes. The voltage drop through the common cables, terminals and battery may lower the primary voltage sufficiently to cause "A" relay drop-out. This, in turn, releases the dynamotor relay initiating a relay "chatter" cycle while high current is flowing through the dynamotor relay. This, of course, shortens the relay contact life.

Low resistance primary and relay control leads, a battery of adequate size sufficiently charged, and good contact at all terminals coupled with periodic checks will not only alleviate this problem but also prevent it from occurring.

ANTENNA MOUNTING

To make efficient use of 25-50 mc. quarter-wave spring base antennas, the antennas should be resonant and should present a 50 ohm resistance to the transmission line and transmitter output circuits. The lack of an adequate ground plane and proximity to the vehicle body make this difficult to achieve in most installations. Antennas therefore are broad banded and the reactance is tuned out in the transmitter output circuits. The ground plane presented by the vehicle top preclude these difficulties in 150 mc. and 450 mc. rooftop antennas.

The following suggestions will aid in obtaining the most satisfactory performance:

1. Mount the antenna as high as possible on the vehicle body.

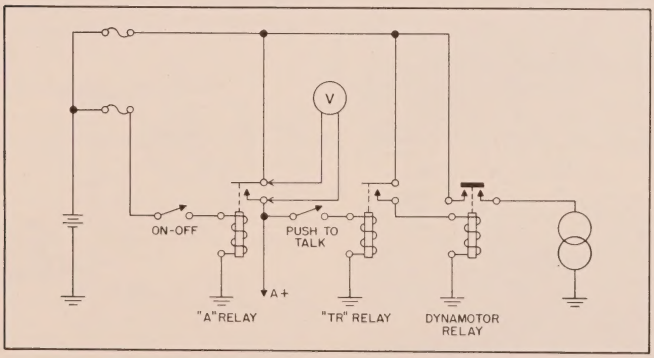
2. Mount the antenna on a portion of the vehicle body which is mechanically strong enough to withstand the "whipping" action.

3. Utilize any possible ground plane to the fullest extent.

4. Avoid mounting the antenna rod in close proximity to the vehicle body for extended lengths.

5. Keep the antenna lead in as short as possible.

6. Use a field strength meter or lamp bulb and leads to assure maximum radiated power.



A simplified partial diagram illustrating the primary current paths in mobile installations which affect relay, dynamotor and vibrator life.

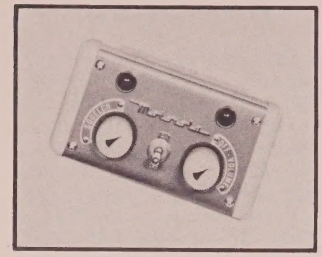
RELAY SEQUENCE

All 250 watt transmitters shipped since March 10, 1952 have included modifications in the control circuits to insure full antenna relay closure before high voltage is applied to the final amplifier. Any possible RF power arcing at the relay contacts is avoided and relay life is lengthed. This same change may be made on earlier versions following the instructions given below. Refer to the applicable schematic diagrams frequently.

In the cabinet cabling of both the FSTR-520BR series and FSTRU-520BR series, remove and discard the YELLOW-BLACK lead connected between terminal 9 on the HV Power & Relay Chassis and terminal 11 on the Meter Panel terminal board at the top of the cabinet. Relocate the BLUE lead from terminal 15 to terminal 9 on the HV Power & Relay Chassis.

In the HV Power & Relay Chassis of 25-50 mc. models (FSTR-520BR series), remove and discard the YELLOW-BLACK lead connecting the bias adjustment resistor, R-4 (500 ohms, 50 watts) to terminal 9 on the terminal board. Ground the open end of R-4. Add a lead from terminal 9 to the tie point between the normally closed contact of the overload relay, K-2, and the coil of the plate contactor relay, K-3.

In the HV Power & Relay Chassis of 152-174 mc. models (FSTRU-520BR series), remove and discard the lead connecting the screen voltage adjustment resistor, R-2 (25,000 ohms, 100 watts) and the bias adjustment resistor, R-6, (200 ohms, 50 watts). Remove the YELLOW-BLACK lead connecting R-6 to terminal 9 of the chassis terminal board. Ground the open ends of both R-2 and R-6. Add a lead connecting terminal 9 to the tie point between the normally closed contact of the overload relay K-2, and the coil of the plate contactor relay, K-3.



PATENTED SQUELCH...

A Circuit Description Of The Motorola Noise Compensated Squelch System. U. S. Patent Number 2343115.

Limiters in an FM receiver are designed to clip the edges of the carrier envelope, blocking both AM modulation and AM noise from the speaker. Normally in virtual saturation from noise excitation alone, limiters draw increasing grid current as the signal strength increases. Limiter grid current is then an indication of RF signal strength and may be used in a control circuit to turn the receiver output circuits "on" only when a predetermined signal strength is reached. The Motorola patented Noise Compensated Squelch System (shown in a simplified form in Fig. 1) utilizes this feature to avoid nuisance noise at the speaker until a signal is received.

NOISE CIRCUITS

When no RF carrier signal is being received, all RF noise passing through the discriminator is fed through a frequency selective network (C-2 and R-2) to the grid of the noise amplifier. Audio frequencies are attenuated but the higher noise frequencies are passed through. The squelch control (R-4), which may be mounted on another chassis, varies the cathode bias and thus the gain of the noise amplifier. The output of the noise amplifier is coupled to the noise rectifier (a voltage doubler as shown). The rectified noise voltage appears across resistor R-5, negative at the anode and positive at the cathode.

SIGNAL CIRCUITS

A negative voltage, from limiter grid current is fed through resistor R-6 to the anode end of resistor R-5. The algebraic sum of the positive noise voltage and the negative limiter voltage appears across capacitor C-5 and forms a bias voltage for the DC amplifier. Normal squelch closed **threshold** voltage will be approximately 0 to ±.5 volts. Since the grid voltage is zero or positive, the DC amplifier conducts, the drop in plate voltage biasing the audio amplifier section of the same tube beyond cut-off. With no amplification in this audio stage, the speaker is quiet.

SQUELCH OPENING

When an RF carrier signal is received, the limiter draws increasing grid current. This makes the limiter grid voltage more negative, overcoming the positive noise voltage. As the sum voltage becomes negative, the DC amplifier is cutoff, the audio amplifier is biased to normal operation, and the signal is heard at the speaker.

THRESHOLD

The setting of the squelch control determines the RF signal strength required to open the squelch. For maximum receiver sensitivity, the squelch control must be set at the point where the noise at the speaker is just quieted or "squelched". A higher setting will block the receiver from reception of the very weak signals. Changes in supply voltage will not change the threshold point. Both the noise voltage and the limiter voltage will change, counterbalancing the sum. Resistor R-8 and Capacitor C-8 provide a time delay to smooth out rapid noise or voltage fluctuations.

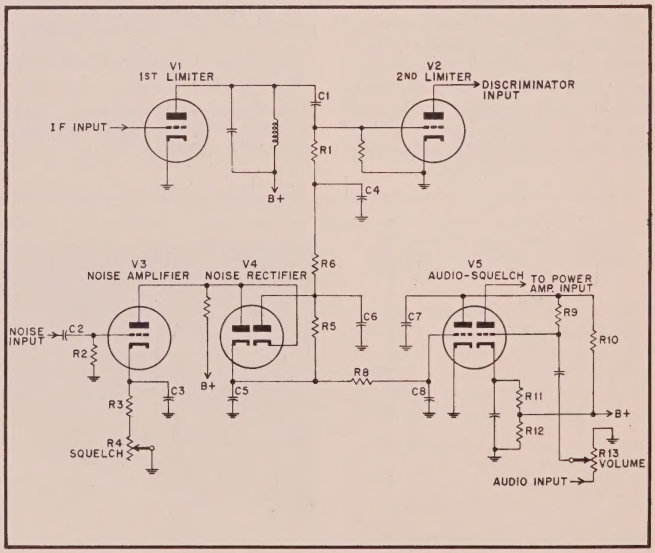


Fig. 1. A simplified partial diagram of the Motorola Noise Compensated Squelch Circuit.

NEW MODELS . . .

Latest Additions to the Motorola "Research" Line.

CONVERTIBLE RECEIVERS

In smaller isolated communities, it is often practical to use radio equipment less selective than the standard adjacent channel models of the Sensicon or Uni-Channel receivers. Where there are no adjacent channel or alternate channel transmitters within many miles and no immediate prospects of such equipment, a less expensive, wider bandwidth receiver is both economical and practical. To meet this need, Motorola supplies the standard Sensicon or Uni-Channel receiver.

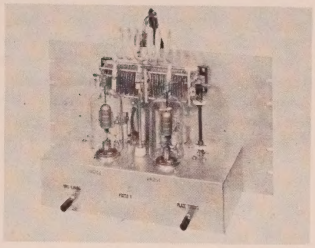
SELECTIVITY

All of the receivers, both in the 25-50 mc. and the 152-174 mc. ranges afford full modulation acceptance with less than 6 db. attenuation at ±15 kc. In the 25-50 mc. range, the alternate channel (±80 kc.) has a nominal attenuation of more than 70 db. and an attenuation of 100 db. at ±120 kc. In the 152-174 mc. range, the adjacent channel (±60 kc.) is attenuated 50 db. and the alternate channel (±120 kc.) is attenuated more than 100 db.

MODELS

All standard models are available with the "X" type filter. Uni-Channel receivers utilize a three-coil "TRI-K" FILTER circuit sealed in polyesterstyrene for permanence and stability. Sensicon receivers utilize a two-coil tunable filter circuit.

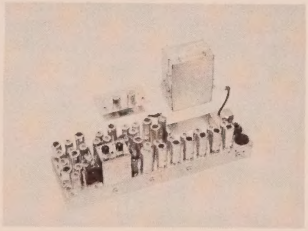
In each case, the filter is mechanically interchangable with the standard PERMAKAY sealed filter unit allowing easy, economical transition to full adjacent-channel or even split-channel operation as system requirements demand.



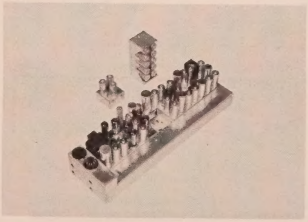
NEW FINAL AMPLIFIER

The Motorola 25-50 mc. 250 watt transmitter final amplifiers are modified to utilize HK-254 tubes. With 500 watts plate input power, more than 250 watts of RF power output is obstained over the full 25-50 mc. range.

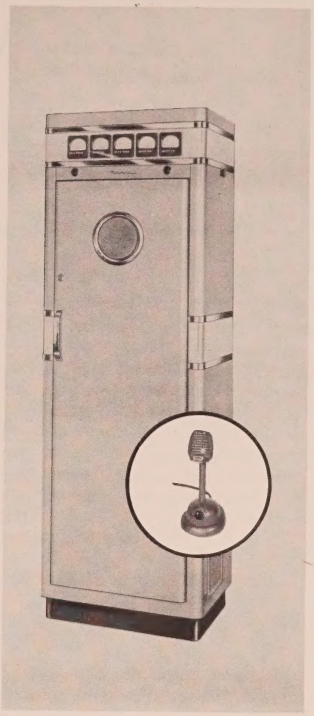
When required by extremely high duty cycles or loading to maximum output power, the LK-254X, rated for higher plate dissipation, may be directly substituted for the HK-254.



SENSICON RECEIVER



UNI-CHANNEL RECEIVER

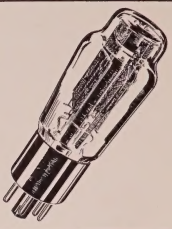


LOCAL CONTROL MODELS

The conventional "BR" upright cabinet, long recognized as a housing for Motorola remotely controlled base station equipment now has a locally controlled counterpart. The new series of "BL" models, designed solely for local and extended local control are supplied in the same basic cabinet, containing the same standard transmitter, receiver and power supply chassis with full built-in metering facilities. A "Magnamike" model P-7245-D controlled reluctance microphone with a 30 foot extension cable is connected to the microphone pre-amplifier mounted on the transmitter chassis. The cabinet speaker is connected to the receiver output circuit. The transmitter is energized with the microphone push-to-talk button.

Models are available for single frequency operation with 30, 60 or 250 watts RF output in both the 25-50 and 152-174 mc. ranges.

VACUUM TUBES



Life Characteristics and Replacement Policy

Modern communications systems employ multitudes of vacuum tubes. The number of tube types may vary from less than ten to over 100. The life characteristics of these tubes vary in type of installation, application, tube type and in the individual tube. An understanding of these factors is essential to proper maintenance, economical operation and optimum equipment performance.

EMISSION

The cathode emission of a new tube is normally considerably higher than necessary for proper operation. Only a small portion of the total emission capability is used. The emission will remain essentially constant over the greater portion of the tube's useful life, decreasing slowly at first, then with increasing rapidity. It is only after the total emission decreases to the point where it affects gain and other tube characteristics that a tube requires replacement.

A "hot" tube, i.e., a tube with high initial emission, is generally the result of a high, built-in cathode temperature. The "hot" tube will decrease in emission more rapidly than the "cold" tube and has a shorter expected life. Thus, the "cold" tube, even though it may be lower than average in emission, is desirable for minimum maintenance and maximum reliability.

CIRCUITS

Tube life is increased in circuits with high negative grid bias and small plate loads. A class A amplifier tube will have a longer expected life than a class C amplifier or oscillator tube.

When a tube is plugged into its socket, an electro-chemical balance is initiated in the cathode which stabilizes after a few hundred hours. Unnecessary switching of tubes to different circuits requires establishment of a new balance at the expense of tube life.

EXTERNAL CONDITIONS

Constant rated filament and B+ voltages contribute to extended life. Wide variations in line voltage at a base station can be countered by a voltage regulating transformer to achieve greater tube life in addition to stabilized performance.

While "ruggedized" versions of some tubes may provide extended life under conditions of vibration, they offer no great advantages for use in fixed stations.

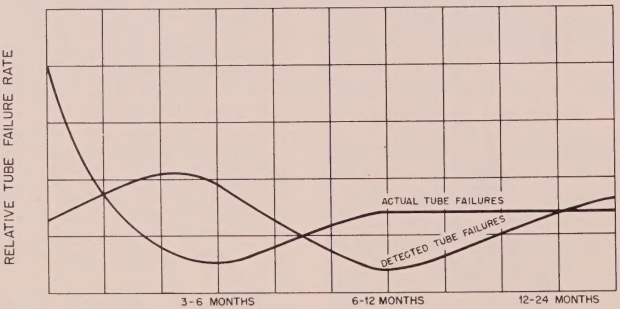
Tubes at 50 hours still have a failure of more than 2-½ times that of tubes in operation at 500 hours. New tubes are much more susceptible to failure. Therefore, new tubes should specifically be watched for symptoms of deterioration during the first month of operation through checks of stage meter readings.

TESTING

The preferred method of testing tubes is measurement of performance of the tube in its associated circuitry. Logged readings at periodic intervals will help in detecting impending tube failures. Stage gain readings, volume or gain control settings, limiter current readings and overall sensitivity are good indications of tube performance. Replacement should not be based on the actual measured performance but rather on the rate of decrease of performance and the extent of degradation from the standard acceptable performance.

Tube testers are an acceptable method of checking high frequency tubes only when performance tests are not feasible. In IF and RF amplifiers and oscillators, tubes that are performing satisfactorily may not register as acceptable on tube testers. The converse is also true.

In no case should a tube be changed because of age alone. Life characteristics vary considerably even between tubes of the same type operating in the same circuit. Replacing tubes unnecessarily jeopardizes reliability and incurs excessive maintenance cost.



Typical vacuum tube failure characteristics in radio equipment showing actual tube life and apparent tube life encountered in maintenance of two-way radio equipment.

POWER LINE CARRIER SYSTEMS

- simplex
- automatic simplex
- duplex

for

Telephone — Telegraph — Teleprinters — Telemeters — Supervisory Control

The equipment termed "Power Line Carrier" by Motorola refers to communications devices operating on carrier frequencies in the 50-200 kc. range and utilizing a metallic conductor as the medium of transmission. In the usual application, voice and/or coded information is conveyed over the transmission or distribution lines of electric power companies. The terminal equipment is basically an FM transmitter and receiver but since the power is confined to conductors rather than radiated, no F.C.C. license is required.

SIMPLEX

The simplex carrier system uses a single frequency for all transmitting and receiving and may consist of a large number of stations all linked on a common "party-line" basis. Simplex operation is confined almost entirely to voice communications for interstation business and power system load dispatching but may also be used in conjunction with certain types of supervisory control and selective telemetering systems.

At each terminal station the transmitter and receiver are connected to the power line through an Aperiodic Line Coupling Unit (Page 22, Motorola Newsgram, Jan.-Feb. 1952). A telephone instrument of the push button ringing or magneto type provides the signalling facility. The telephone handset is equipped with a push-to-talk button for talking, thus establishing the term "push-to-talk" simplex. Signalling and ringing are automatically accomplished through integral circuits in the terminal.

AUTOMATIC SIMPLEX

The automatic simplex carrier system is an expansion of the "push-to-talk" simplex system wherein a voice operated transfer chassis (Page 23, Motorola Newsgram, Jan.-Feb. 1952) automatically turns the transmitter on when speech begins. The same basic equipment is used at each terminal but the automatic control feature permits easy connection of the terminal into either manual or dial switchboards of private or public telephone systems.

DUPLEX

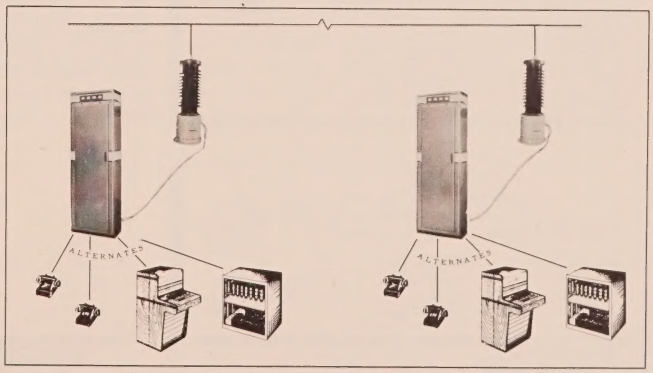
The duplex carrier system utilizes two frequencies, one for transmitting in one direction and one for transmitting in the other direction. Simultaneous traffic may be handled in both directions. This makes the duplex system suitable for telemetering, teleprinters and supervisory control. Although it occupies two carrier channels, spectrum conservation is afforded by multiplexing up to 18 channels of telegraph, teleprinter or telemeter information on each channel or by multiplexing voice with various types of coded information on a single frequency. Like automatic simplex, the duplex system is designed to work with manual and dial telephone exchanges with either local battery or common battery telephones.

SYSTEMS

The power line circuit must offer a continuous path for the carrier thus making it necessary to use the Aperiodic Line Coupling Unit to bypass circuit breakers, transformers and other line discontinuities. It may also be necessary to use line traps on stubs or feeders to prevent division of the signal power or interference between two carrier systems on the same frequency.

AUDIO SPECTRUM

The total audio spectrum of a carrier channel is approximately 100 to 3200 cps. Audio frequency carrier, used for teleprinters, telemeters and telegraph utilizes 18 channels from 500 to 3100 cps. The upper channels, separated from a voice signal with suitable audio frequency filters, may easily be multiplexed on the same carrier channel with voice. Similarly, supervisory control signals in the 100-312 cps range may be multiplexed with voice with no interaction between signals.



An illustration of a typical two terminal duplex carrier system showing the Aperiodic Line Coupling Unit, the carrier terminal cabinet and the telephone terminations for voice communications.

Designing a FIRE SERVICE RADIO SYSTEM

High ambient audio noise levels, the necessity for rapid but sure message transmission and the requirements for dependable mobile-to-mobile and portable-to-mobile communications under adverse conditions means that fire service radio must consist of the best equipment integrated into a well designed system for maximum utility.

Fire service radio often requires versatility above and beyond that of conventional mobile radio applications. To meet this challenge, Motorola engineering produces several standard types of fire radio systems and periodically is called upon to provide highly complex, intricate systems for special applications.

MOBILE EQUIPMENT

The simplest equipment consists of a standard mobile radio model which includes a transmitter, receiver and power supply contained within a closed housing, plus the antenna, speaker, control head, microphone and associated accessories. The standard mobile housing may, of course, be mounted within a separate weatherproof housing.

High noise levels, engine noise, wind or other factors may dictate the desirability of high audio output levels. In this case, an audio amplifier and additional speaker are added to the basic unit to provide 8 to 10 watts of output power, audible even under the worst conditions.

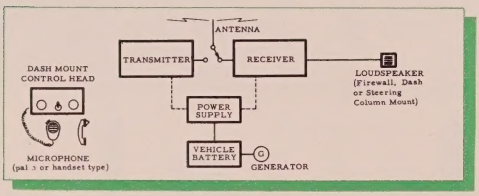
The megaphone and shouted command may also be replaced by radio. With the addition of a second control head, the audio booster amplifier doubles as a public address amplifier. The heavy duty weatherproof speaker may be rotated in the vertical plane as well as through 360 degrees in the horizontal plane. Voice commands may be transmitted to firemen, other fire companies or to onlookers.

PORTABLE RADIO

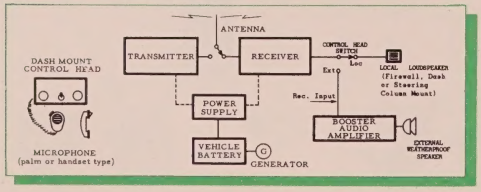
A fireman equipped with a Handie-Talkie portable radiophone can go up to, as well as into, the fire and still maintain instantaneous voice communications with his supervising officer. The chief keeps in close contact with his men, ascertaining the progress of the fire and determining the combative measures necessary. Instantaneous instructions are given to each crew as required, regardless of location in the area. Either the hand-carried or backpack type of portables may be used to set up command posts at strategic locations.

2-WAY SYSTEMS

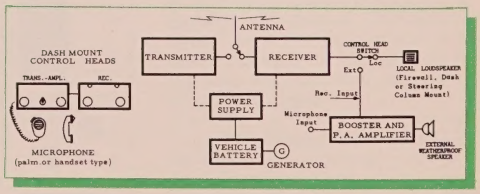
A system may be established on the simplex (single frequency)



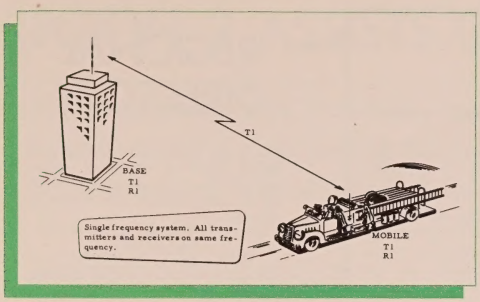
The basic building blocks for any mobile radio installation are shown in this block diagram of a standard 2-way radio.

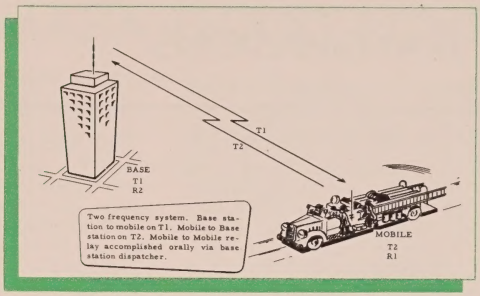


An audio booster amplifier added to the basic radio unit increases the audio output level of the receiver to over-ride external noise.



The audio booster amplifier may also be used as a public address amplifier with 8 to 10 watts of output for voice communication or supervision.





basis. This system is similar to a party line with one station talking at a time and all other stations able to hear both sides of each conversation. This type of operation is entirely satisfactory in smaller systems.

A second system utilizes different transmitting and receiving frequencies. The base station talks out to the mobile units on one frequency and receives on a second frequency. There is no direct communication between mobile units—messages are relayed through the base station. This system enables the base station to make urgent calls to a mobile unit even though another mobile unit may be transmitting. Similarly, the base station may receive urgent or emergency calls during transmission of lengthy routine messages.

3-WAY SYSTEMS

Three-way communication is provided by using a second transmitting frequency in each mobile unit. This system is particularly adaptable to combined fire-police radio networks. Full instantaneous communication can be maintained between vehicles at a fire or enroute to a fire. Portable radiophones are often used on the mobile receiver frequency.

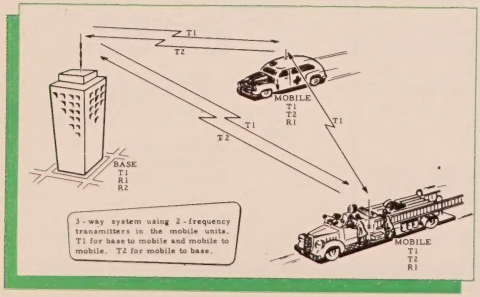
INSTALLATIONS

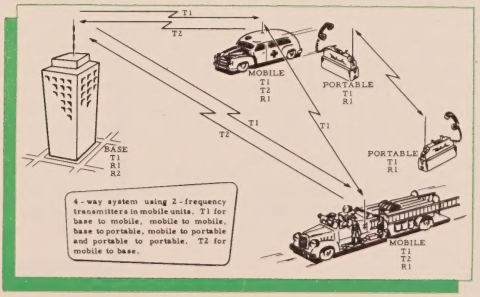
Radio equipment installed in vehicles of all fire companies with a base station at central fire headquarters will be adequate for smaller fire service organizations. A single base station will often suffice for the combined use of police, fire and public utilities. As the organization becomes more complex, radio equipment is added in the chief's car, the assistant or district chiefs' cars, inspector's cars, all fire houses, fireboats, drawbridges, traffic control points and perhaps in the home of the fire commissioner or fire chief. In larger metropolitan areas, it may be necessary to use several transmitters for the fire department to sectionalize the area into several districts.

SPECIAL SYSTEMS

Multitudinous variations of standard systems have been produced for special applications. Oneida County, N. Y. utilizes a radio repeater system with QUIK-CALL at strategic locations to summon volunteer fire companies by actuating sirens or other signaling devices. The New York City Fire Department, with over 500 mobile units, now covers the entire metropolitan area in four districts with four main transmitters. Expansion facilities permit the use of four additional frequencies as required.

Hundreds of other fire radio systems based on Motorola equipment have provided the knowledge and experience which makes Motorola radio the ideal foundation for dependable and satisfactory communications networks.





TRANSMISSIONS . . . . .

About Motorola 2-Way Radio Users

FOR DETECTIVES ONLY . . . .

The Supreme Court recently upheld the secret use of walkie-talkie sets such as Motorola's "Handie-Talkie" Units by federal narcotics investigators to obtain opium sale evidence against a New York City dope peddler. According to Supreme Court Justice Jackson, this method is no more forbidden to officers than bifocal spectacles, field glasses or telescope.

A PIRATE AND A PORTABLE . . . .

Motorola's "Handie-Talkie" Portable Units and alert publicity men go hand-in-hand. To cover the Gasparilla Carnival extravaganza held in connection with the Florida West Coast pageant at Tampa, six staff announcers of WFLA-AM-FM of Tampa turned to two-way radio. With remote control equipment, mobile units and "Handie-Talkie" Units, they covered every important and interesting carnival highlight. Announcer Gordon Solie (left), dressed as an ancient mariner, put out to sea on a pirate ship to review the ship-to-shore operations as the pirates sailed into port.

For Tampa's radio listeners, it was the most complete radio coverage given any special event in the city's history.

FISHERMEN BEWARE . . . .

In New York's Finger Lakes region, Conservation Department officials have a new tool for tracking down conservation law violators. A specially trained squadron of game protectors armed with five radio-equipped motorcycles, a radio-equipped car and several "Handie-Talkie" FM Portable Radio Phones will continuously search out the "trouble spots".

RADIO-EQUIPPED ANIMAL AMBULANCES . . . .

When any of Columbus, Ohio's small animals accidently get that "run down" feeling brought about by their own carelessness in making a street crossing, they will receive a quick trip to the animal hospital. Recently the Columbus Humane Society equipped three of their twelve animal vehicles with Motorola 2-way radio. Two vehicles patrol the street during the daytime, one at night.

Slated to have radio installed at a later date are six more small animal ambulances plus a boat and a boat trailer used to rescue animals stranded in high water. A large radio dispatched ambulance equipped with a hoist and boom will also go into operation soon.

REGIONAL DIRECTORY

For your convenience there is listed below a complete directory of Motorola Regional Managers, their offices and territory covered.

REGION 1
HENRY C. GAMMELL
Arizona, California, Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Utah.
Office: 1355 Market Street
San Francisco, Calif.
Phone: MARKET 1-8462

REGION 2
EUGENE F. BROWN
Colorado, Iowa, Kansas, Minnesota, Nebraska, North Dakota, South Dakota.
Office: 817 Kilpatrick Bldg.
Omaha, Nebraska
Phone: WEBSTER 0017

REGION 3
HOMER L. MARRS
Illinois, Indiana, Missouri, Wisconsin.
Office: 1327 W. Washington Blvd.
Chicago, Illinois
Phone: TAYLOR 9-2200

REGION 4
GLENN MUNRO
Kentucky, Michigan, Ohio, Tennessee.
Office: 19142 James Couzens Hwy.
Detroit 35, Michigan
Phone: UNIVERSITY 3-6464

REGION 5
EDWARD L. FALLS, JR.
Arkansas, Louisiana, New Mexico, Oklahoma, Texas.
Office: 3230 Louisiana Ave.
Houston 6, Texas
Phone: LINDEN 7593

REGION 6
HORACE E. BOYLAN
Alabama, Florida, Georgia, Mississippi, South Carolina.
Office: Stallings Bldg., Rm. 601
1829 First Ave., North
Birmingham, Alabama
Phone: 4-4582

REGION 7
L. HARRISS ROBINSON
Delaware, Maryland, North Carolina, Virginia, Washington, D.C., West Virginia.
Office: 2309 Calvert St., N.W.
Washington 8, D. C.
Phone: ADAMS 5620

REGION 8
P. R. KENDALL
Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.
Office: 540 Main Street
Winchester, Mass.
Phone: 6-2482

REGION 9
LOWELL E. WHITE
New Jersey, New York, Pennsylvania.
Office: 102 Linwood Plaza
Fort Lee, New Jersey
Phone: 8-9100

REGION 2 ASSISTS OMAHA FLOOD FIGHT

All Motorolans join the many public safety agencies and public service organizations in their expression of gratitude to Eugene F. Brown and his Radio Communications Engineers of Region 2. Their assistance in setting up an emergency radio network to combat impending flood disaster in the cities of Omaha and Council Bluffs contributed greatly to the successful flood control effort.

Eugene F. Brown, Sales Manager of Motorola's Region 2.

CITY OF OMAHA
FIRE DEPARTMENT

WM. DEAN NOYES, COMMISSIONER
403 CITY HALL
HA. 3083

CLYDE DUNN, CHIEF
319 SO. 19TH STREET
HA. 3727

May 12, 1952.

Mr. Eugene F. Brown, Divisional Representative
Motorola Radio Corporation
817 Kilpatrick Building
Omaha, Nebraska

Dear Gene:

I hope that this letter will serve in some small way to express my sincere appreciation for the cooperation shown by you and Motorola during our recent flood crisis. Your prompt response in securing a sufficient number of Walkie-Talkies for levee patrol work was a life-saver.

Since I was on the emergency sites night and day with Mr. E. I. Myers, the Flood Control Co-ordinator, and was using Motorola equipment constantly, I am perhaps more familiar with the great part this type of communication played in winning the battle against the Missouri than anyone in Omaha.

We were never out of contact with the Flood Control Headquarters nor with the Omaha Police Department during the entire time of anxiety. When men, material, food, drinking water or police escorts were needed they were readily directed to the scene through Motorola Walkie-Talkie or by my Motorola car radio. Were it not for these units, I cannot conceive of how the situation might have been handled without disaster, for all of the telephones in the flood threatened area, except at remote points, had been removed. We not only had direct contact with the main stations, but also inter-communications from levee patrol to levee patrol, car to car, Walkie-Talkie to car, etc.

This near disaster and the great part played by Motorola equipment has probably done more to substantiate my advocacy of this type communication for Omaha's Fire Department and Police Department than anything else could have done.

Again, a heartfelt thanks to you and Motorola from me and the citizens of Omaha.

Yours truly,

Wm. Dean Noyes
WM. DEAN NOYES, FIRE COMMISSIONER

WDN:NR

From Harold P. Caldwell, Commissioner of Police and Public Safety, City of Omaha to Eugene F. Brown: "I take this opportunity of commending you and your Organization for the assistance given to us during the flood emergency. It was a job well done and each and every member of our Department express our thanks."

And from W. B. Haas, Superintendent of Pipe Lines, Northern Natural Gas Company, " . . . may we express our deep appreciation for the outstanding job Motorola, Inc. performed in delivering six walkie-talkies (Motorola "Handie-Talkie" Units) to Northern on such short notice for use during the Missouri River flood emergency. I again extend my personal appreciation to you and your company for assisting us."

Motorola Announces

Another Best-Choice for You

NEW

450-470 Mc.

2-Way Radio Communication Equipment for New Public Safety, Land Transportation, Industrial, and Citizen Bands

With the famous Sensicon circuit and Permakay selectivity sealed unit

2-WAY RADIO

BROUGHT TO FULL SUCCESS BY

Motorola

WORLD LEADERS IN 2-WAY RADIO

Now you can have all the advantages of uncongested non-interference operation up in the 450 megacycle range . . .

. . . for F.C.C. has given you the space, and Motorola has built for you the quality tool for best results. It is now released for sale to you after more than 2 years of rigorous testing and service in the field.

Here, once again, Motorola has put your best long-term *value* ahead of everything. It will save you up to 25% in maintenance alone.

This completely new design has the same guaranteed, obsolescence-free features that make Motorola equipment *all-ways* your best buy!

—the one others always try to copy

Additional Details Available Upon Request

Motorola, Inc.
Technical Information Center
Communications & Electronics Division
4545 Augusta Blvd., Chicago 51, Illinois